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(6) 発明の名称 挿苗機における給苗装置

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明細書

1. 発明の名称

挿苗機における給苗装置

2. 特許請求の範囲

植込杆を間欠的に昇降してその先端に備える開閉自在な挿苗爪により苗を植付ける挿苗機において、

前記植込杆を昇降する間欠回転軸に苗搬送用無端チェーンのチェーン駆動軸を連結し、該無端チェーンには多数の苗受台を等間隔に配列し、これら苗受台の苗を前記挿苗爪に供給するようにして成る給苗装置。

3. 発明の詳細な説明

(産業上の利用分野)

本発明は、植込杆を上下に動かしながら挿苗爪を開閉して苗を植付ける挿苗機の給苗装置に関するもの。

(従来の技術)

従来の挿苗機においては、間欠的に回転する円

盤状の給苗台を水平に設置し、これにポット状の苗受器を多數同心的に配設して成り、作業者は苗受器に順次苗を投入し、挿苗杆は苗受器の底部に設けた孔から順次苗を引出して受取って畠に植付ける構成の給苗装置が知られている。

(発明が解決しようとする課題)

しかし、この従来のポット状の苗受器を用いた給苗装置によってさつまいものつるのような比較的細い種類の苗を植付ける場合には、上記ポット状の苗受器の孔から苗を脱落してしまうことがあり、これを解消すべく孔を小さくすると、孔から苗を引出す際に苗を傷付けるという問題点があった。

このため、2枚の挟持バネに苗を挟持させる構成の苗ホルダを設けた苗受器が提案されているが、この場合、作業者は円周方向に一定速度で常に回動する苗受台の苗ホルダに苗をセットしなければならず、さらに挿苗機自体は前進運動するものであるため、その作業は甚だ不確実であり、しばしば欠株を生じるという問題点があった。

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本発明は、作業者が苗受台に苗をセットしやすく確実に苗を移植することができ、また構成を簡単にして価格の低減を図ることができる給苗装置を提供することを目的とする。

(課題を解決するための手段)

上記目的を達成するために、本発明の給苗装置は、植込杆を昇降する間欠回転軸に苗搬送用無端チェーンのチェーン駆動軸を連結し、該無端チェーンには多数の苗受台を等間隔に配列し、これら苗受台の苗を前記植込杆の挿苗爪に供給する構成とする。

(作用)

上記のように構成した給苗装置は、植込杆を昇降する間欠回転軸を駆動すると、植込杆が昇降すると同時に苗搬送用無端チェーンのチェーン駆動軸が回転し、上記無端チェーン上の苗受台が間欠的に送り運動を行う。

(実施例)

実施例について図面を参照して説明する。

第2図及び第3図は、本発明を実施した挿苗機

挿苗杆13を下向きに固定し、挿苗杆13の先端には開閉する挿苗爪14を設ける。挿苗杆13の基部には、挿苗爪14の開閉を行う適宜な挿苗爪開閉装置Mを設ける。

そして植込杆駆動軸7に、さらにスプロケット15、チェーン16、スプロケット17、傘歯車18、19を設ける。傘歯車19に車体の進行方向に沿うチェーン駆動軸20を固着し、この軸20にスプロケット21を固着する。またスプロケット22を21の側方に、スプロケット23を21の下方に設け、その周囲に苗搬送用無端チェーン24を巻回する。給苗装置Tの後部にも、スプロケット21、22及び23と同様にスプロケットを配し、それらにチェーン24と同様に苗搬送用無端チェーンを巻回する。これら2本のチェーン間に多数個の苗受台25の前端と後端を夫々螺着する。苗受台25の上面には苗Sをセットする為のバネ式の苗ホルダ26を設ける。28は苗カバーで、苗受台25の苗Sが自重で垂れ下がらないように案内する。

の全体を示す。この挿苗機は、左右の前輪41、41及び駆動輪42、42により歯27をまたぎ、駆動輪42、42の回転により前進する。作業者が給苗装置Tの苗受台25に、さつまいものつるのような苗Sを一本ずつセットすると、植込杆12の挿苗爪14がこの苗Sを給苗装置Tより受取って歯27に植付けるものである。

第4図及び第5図において、エンジンRの出力軸1に、ピン2及びスペーサ9を有する原車3を取り付ける。軸4に、90度間隔に半径方向の溝5aが4箇所ついたゼネバ歯車5を、原車3のピン2に溝5aを咬合するように取付け、さらに軸4に歯車6を取り付ける。植込杆駆動軸7に、歯車6の1/4の歯数を有する歯車8を取り付け、この歯車8と原車6を咬合し、間欠運動機構Kを構成する。

第1図において、挿苗機の車体に植込杆12の基部12aを軸支する。植込杆駆動軸7にクランクアーム13を固着し、その先端と植込杆12をリンク14により連結する。植込杆12の先端に

しかしてエンジンRの出力軸1を回転すると、挿苗機全体が前進し、これと同時に間欠運動機構Kの内部に設けた原車3が反時計方向に回転する。原車3のピン2はゼネバ歯車5の溝5aに咬合した後、ゼネバ歯車5を時計方向に90度回転させる。ゼネバ歯車5の回転が歯車6を介して歯車8に伝えられ、植込杆駆動軸7が反時計方向に間欠的に1回転する。

植込杆駆動軸7が回転すると、クランクアーム13とリンク14を経て動力が植込杆12に伝達し、植込杆12はその基部12aを支点に間欠的に昇降運動する。

そして同時に、スプロケット15を介してチェーン16、傘歯車18及び19が回転し、これにより苗搬送用無端チェーンが駆動し、苗受台25がスプロケット21、22、23の周囲を間欠的に移動する。

作業者は、給苗装置Tの上面を間欠的に移動する苗受台25が停止している間に、苗Sを1本ずつ苗受台25の苗ホルダ26に挿む。苗Sを積載

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した苗受台25は給苗装置Tの下部の給苗位置に順次送られ、給苗位置において挿苗爪14が苗Sを持持したのち歯27に植付ける。以下これらの動作を連続して行う。

(発明の効果)

本発明は、以上説明したとおりに構成したので、以下に記載する効果を奏する。

苗搬送用無端チェーンに苗受台を取付け、苗受台を間欠的に駆動するので、作業者が苗受台に苗をセットしやすく、確実に苗を移植することができる。

また同じ間欠回転軸によって挿込杆及び給苗装置を駆動するため、装置の構成が簡単になり価格の低減を図ることができる。

4. 図面の簡単な説明

第1図は本発明の実施例の挿苗杆および給苗装置の斜視図、第2図は本発明の実施例の挿苗機の全体平面図、第3図はその全体側面図、第4図はゼネバ歯車機構を用いた実施例の間欠運動機構の側面図、第5図はその平面図である。

1…エンジンRの出力軸、3…原車、5…ゼネバ歯車、6, 8…歯車、7…挿込杆駆動軸、13, 17, 21, 22, 23…スプロケット、16, 24…チェーン、18, 19…傘歯車、25…苗受台、26…苗ホルダ、27…歯、K…間欠運動機構、M…往復動装置、R…エンジン、S…苗、T…給苗装置

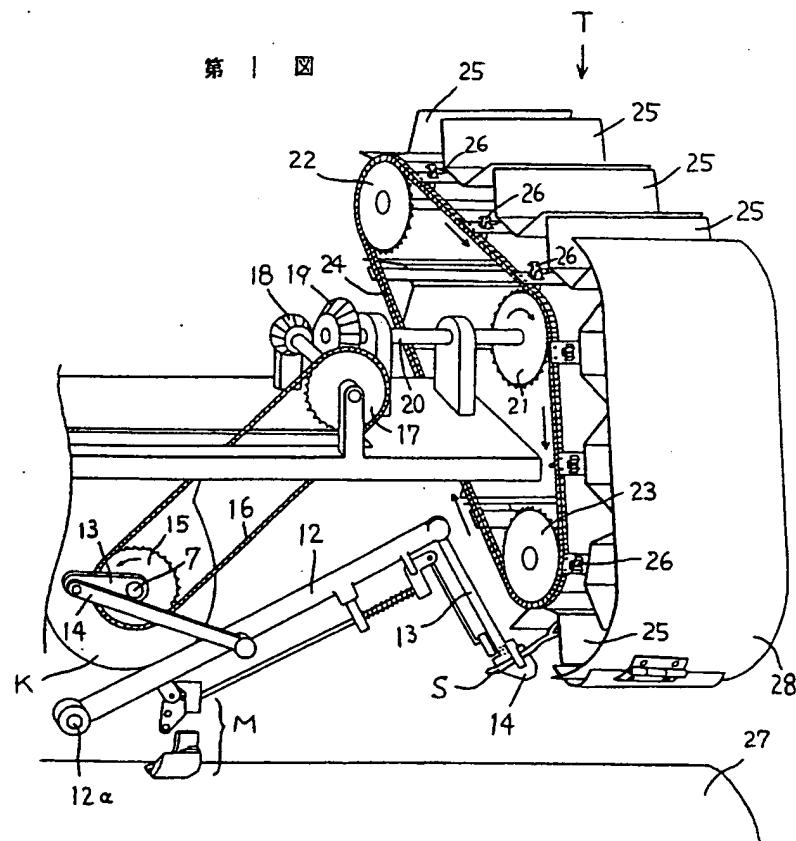
特許出願人

マメトラ農機株式会社

代理人

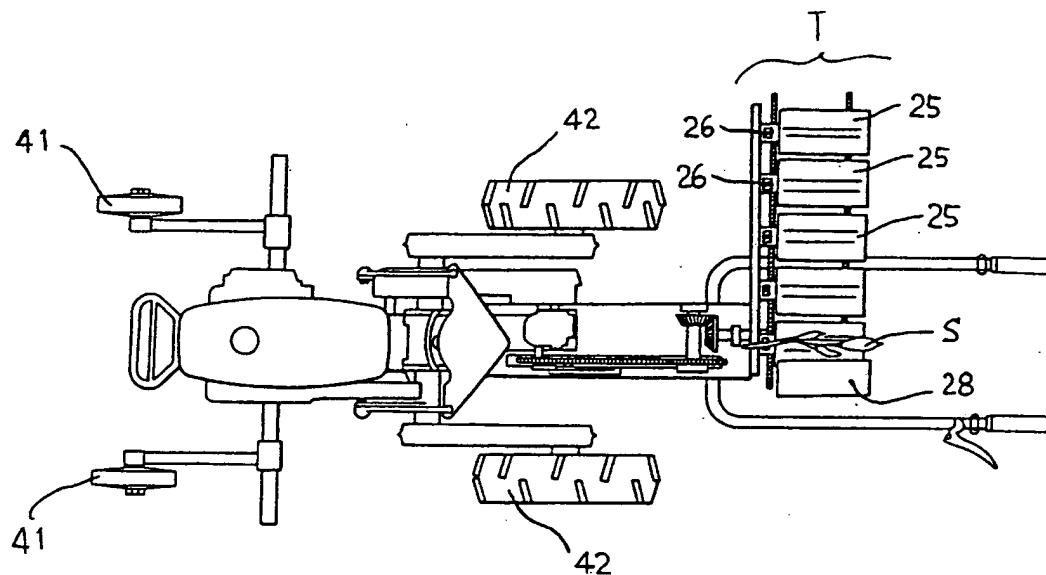
牧 哲郎（ほか3名）

第1図

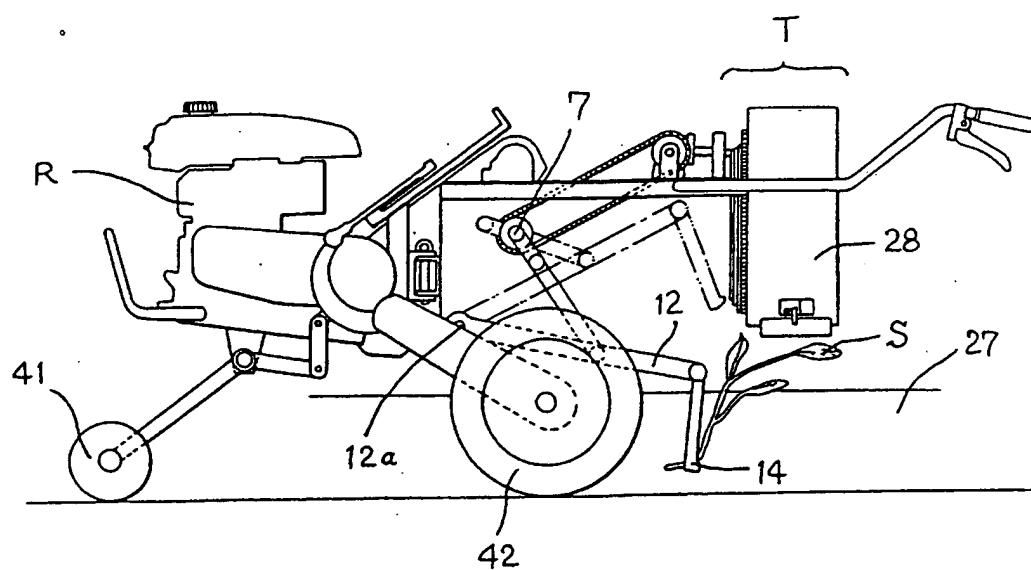


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第 2 図

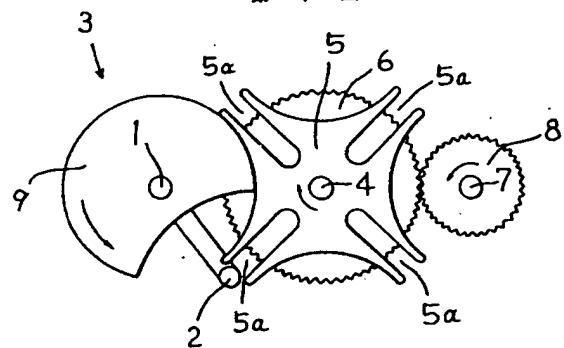


第 3 図

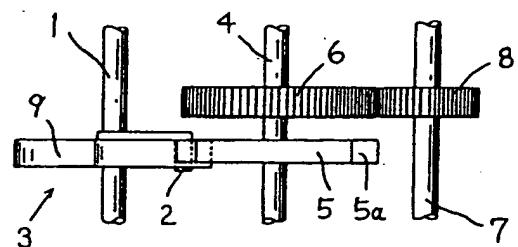


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第4図



第5図



Date: September 7, 2005

Declaration

I, Michihiko Matsuba, President of Fukuyama Sangyo Honyaku Center, Ltd., of 16-3, 2-chome, Nogami-cho, Fukuyama, Japan, do solemnly and sincerely declare that I understand well both the Japanese and English languages and that the attached document in English is a full and faithful translation of the copy of Japanese Unexamined Patent No. Hei-4-36107 laid open on June 15, 1992.



Michihiko Matsuba

Fukuyama Sangyo Honyaku Center, Ltd.

CRYSTALLIZED GLASS AND METHOD FOR PRODUCTION THEREOF

Japanese Unexamined Patent No. Hei-4-36107

Laid-open on: June 15, 1992

Application No. Sho-60-45123

Filed on: March 6, 1985

Inventor: Takehiro SHIBUYA, et al.

Applicant: Nippon Electric Glass Co., Ltd.

SPECIFICATION

TITLE OF THE INVENTION

Crystallized glass and method for production thereof

WHAT IS CLAIMED IS;

1. Crystallized glass having a composition wherein at least 90% or more is composed of 48.2 to 53.0% SiO₂, 35.9 to 44.0% CaO and 3.5 to 7.5% MgO and 10% or less of impurities by weight percentage and containing no P₂O₅, characterized by having a structure wherein many dense wollastonite (CaO·SiO₂) crystals and diopside (CaO·MgO·2SiO₂) crystals are dispersed in the glass.

2. The crystallized glass according to Claim 1 wherein 10% by weight or less of one or two or more of any of Al₂O₃, B₂O₃, Na₂O, K₂O, Li₂O, BaO, SrO, ZnO, TiO₂, ZrO₂, Nb₂O₅, Ta₂O₅ and CaF₂ is

contained as the impurities.

3. A method for producing crystallized glass having a composition wherein at least 90% or more is composed of 48.2 to 53.0% SiO₂, 35.9 to 44.0% CaO and 3.5 to 7.5% MgO and 10% or less of impurities by weight percentage and containing no P₂O₅, characterized in that glass powder with a particle size of 200 mesh or less is molded, subsequently heated at a temperature range of glass powder burning and then heated at a temperature range of crystal precipitation.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to crystallized glass whose various intended uses are anticipated as artificial bones, dental materials such as artificial tooth crowns and artificial tooth roots or industrial materials, and a method for production thereof.

Conventionally, as the artificial bone and the dental material, metallic materials such as silver and tantalum, alloy materials such as cobalt and chromium alloy, titanium alloy and stainless steel, and polymer materials such as polymethyl methacrylate and high strength polyethylene have been used. However, the metallic and alloy materials are excellent in strength but are poor in affinity with living tissues. When used in the human body for a long time, it has been likely that

metallic ions are eluted and damage the living tissue. Alternatively, the polymer material is stable in vivo, but has low strength, and is not chemically bound to the bone. Thus, the polymer material can be used for only limited portions, and additionally an unreacted monomer left upon production has been likely to elute to damage the living tissue. On the contrary, ceramic materials such as alumina ceramic are excellent in strength as well as in bioaffinity, and components eluted therefrom are unlikely to adversely affect the human body. Thus, they have attracted much attention as artificial bones and dental materials. However, since alumina ceramic is not chemically bound to the bone, when a shape of ceramic holes in which newly formed bone is penetrated is inadequate, stress is concentrated at a part of the bone or the ceramic and it has been likely that the bone is absorbed or the ceramic is destroyed. Thus, $\text{Na}_2\text{O}-\text{CaO}-\text{SiO}_2-\text{P}_2\text{O}_5$ based crystallized glass and apatite sintered bodies have been designed as the ceramic material which is chemically bound to the bone, but these have a drawback that the mechanical strength is low or the production is not easy.

Also conventionally, the crystallized glass has been used as precision parts and insulation materials in the materials field for industry. Generally, the crystallized glass used for

industrial materials is characterized in that the glass is uniformly melted, subsequently molded into a desired shape by a glass molding method such as press, blowing, casting or roll substrate and then heated at a temperature range at which crystallization is carried forward to make a structure in which crystals are dispersed in glass matrix. However, the conventional crystallized glass shrinks in this crystallization step. Thus, a dimension accuracy is poor, and chipping and cracking occur when cutting and polishing are performed after the crystallization to widely reduce the strength. Therefore, the conventional crystallized glass has been difficult to apply to precision parts and parts requiring post-processing.

The present invention has been made to solve the above drawbacks, and provides crystallized glass having various excellent properties as artificial bones, dental materials and industrial materials, and a method for easily producing the same.

The crystallized glass of the present invention has a composition wherein at least 90% or more is composed of 48.2 to 53.0% SiO₂, 35.9 to 44.0% CaO and 3.5 to 7.5% MgO and 10% or less of impurities by weight percentage and contains no P₂O₅, and is characterized by having a structure wherein many dense

wollastonite ($\text{CaO}\cdot\text{SiO}_2$) crystals and diopside ($\text{CaO}\cdot\text{MgO}\cdot2\text{SiO}_2$) crystals are dispersed in the glass.

The method for producing the crystallized glass of the present invention is characterized in that glass powder of the above composition with a particle size of 200 mesh or less is molded, subsequently a dense premolded body previously molded into a desired shape is made, then heated at a temperature range of glass powder sintering, and further heated at a temperature range of crystal precipitation.

A crystallized glass product produced in this way has a dense structure with no gap, and additionally the crystals are formed and grown in each powder particle and simultaneously grown from a powder particle surface toward an inside. Therefore, the product has a crystal structure in which the crystals are complicatedly intertwined. As a result, the product has high strength, no chipping and cracking occur when processing such as cutting, polishing and cutoff is given, can provide the crystallized glass with good mechanical workability without reducing the strength, and is easily applied to the artificial bone with a complicated shape.

Differently from the $\text{P}_2\text{O}_5\text{-CaO}$ based glass and the apatite sintered body proposed conventionally, the present crystallized glass is characterized by adhesively integrating

with a bone or tooth in vivo by precipitating the wollastonite crystal as one type of precipitated crystals even though no P_2O_5 is contained in the component.

That is, the wollastonite crystal is bound to and integrated with the bone or tooth by thoroughly dissolving in a body fluid, i.e., saline, forming a layer with high concentration of Ca^{2+} ions closely to a material surface, and binding the ions to HPO_4^{2-} and PO_4^{3-} in the body fluid to form an apatite crystal layer on the material surface.

The dense crystals in the crystallized glass of the present invention are composed of acicular crystals of the wollastonite crystal and the diopside crystal. Both are complicatedly intertwined to enhance the mechanical strength of the crystallized glass. Therefore, a crystallized glass is obtained whose mechanical strength is higher due to interaction of both crystals, chipping and cracking do not occur in a cutting or polishing step, and mechanical workability is favorable.

Due to the following reasons, the composition range of the crystallized glass of the invention is limited to the above.

When SiO_2 is less than 48.2%, devitrification is high, dissolution and molding of the glass become difficult, and at the same time, the wollastonite crystal and the diopside

crystal are precipitated in only a small amount. When SiO_2 is more than 53.0% or more than 60%, the viscosity of a melted solution becomes high and the dissolution of the glass becomes difficult.

When CaO is less than 35.9%, the wollastonite crystal and the diopside crystal in the glass are precipitated in only a small amount. When CaO is more than 44%, the devitrification becomes high, and vitrification of the melted solution becomes difficult.

When MgO is less than 3.5%, the viscosity of the melted glass becomes high, uniform melting becomes difficult and the diopside crystal is not precipitated. When MgO is more than 7.5%, the devitrification becomes high, and vitrification of the melted solution becomes difficult.

Additionally, it is possible to contain one or two or more of any of Al_2O_3 , B_2O_3 , Na_2O , K_2O , Li_2O , BaO , SrO , ZnO , TiO_2 , ZrO_2 , Nb_2O_3 , Ta_2O_5 and CaF_2 at 10% by weight or less as the impurities in addition to the above composition. But, when a total of these additive components is more than 10% by weight or when the other component such as P_2O_5 is contained, such a case is not preferable because an amount and a type of the precipitated crystal is changed, and the mechanical strength and the mechanical workability are reduced.

The method for producing the crystallized glass of the present invention is characterized in that the uniformly melted glass is made into powder with 200 mesh or less using a pulverizer such as a ball mill, it is press-molded into a predetermined shape, subsequently heated at a temperature range of glass powder sintering, and then heated at a temperature range of crystal precipitation. The former heating treatment is important for obtaining the crystallized glass with small porosity and large mechanical strength, and the latter heating treatment is important for precipitating numerous dense crystals, i.e., wollastonite crystals and the diopside crystals from the glass.

Making the glass into powder with a particle size of 200 mesh or less is an important condition for obtaining the crystallized glass with less pores, where the wollastonite crystals and the diopside crystals have been uniformly precipitated in a finely particulate form. When the melted solution is directly molded into the glass with a predetermined shape, which is then treated with heat, the wollastonite crystal is precipitated only from the glass surface, and thus only the crystallized glass with low mechanical strength having internal cracks is obtained.

The temperature range of the glass powder sintering is the

temperature range from a heat shrinkage starting temperature to a heat shrinkage terminating temperature, and is obtained by heating the glass powder molded body at a constant rate and measuring the heat shrinkage through that period.

The temperature range of the crystal precipitation is the temperature range from an exothermic heat starting temperature due to the crystal precipitation to an exothermic heat terminating temperature, and is obtained by heating the glass powder at a constant rate and performing a differential thermal analysis through that period.

An Example of the glasses of the present invention in the following Table 1 is shown.

Table 1- Example

Sample No. Composition	1	2	3	4	5	6	7	8
SiO ₂	52.5	53.0	50.5	48.6	48.2	50.0	51.0	50.5
MgO	3.5	7.5	7.1	6.9	6.8	7.0	7.2	7.1
CaO	44.0	39.5	37.6	36.2	35.9	37.3	38.0	37.6
B ₂ O ₃			4.8		4.5		1.9	
Al ₂ O ₃				4.6	2.8			
Na ₂ O				2.8	0.9	1.9		
K ₂ O				0.9	0.9			
BaO								2.9
ZnO						1.9		
TiO ₂							1.9	
Ta ₂ O ₅						1.9		
CaF ₂								1.9

Flexural strength kg/cm ²	2000	1900	1800	2000	1800	1900	2000	2000
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The glass samples in the Example in the above Table 1 were prepared as follows.

A batch formulated to make the glass composition in the Example is prepared using raw materials of oxide, carbonate, hydrate or fluoride, placed into a platinum crucible, and melted in an electric furnace at 1400 to 1500°C for 4 hours. Then, the melted solution is run through water-cooled rollers to make into ribbon-shaped glass, and pulverized into powder with a particle size of 200 mesh or less. The powder is molded into a predetermined shape by isostatic pressing, subsequently heated in the electric furnace at room temperature to 1050°C at a rate of 30 to 60°C/hr, sintered and crystallized by retaining at 1050°C for 2 to 10 hours, and cooled to room temperature at 30 to 120°C/hr.

The crystallized glass produced by such a method has the dense structure in which numerous wollastonite crystals and the diopside crystals have been precipitated in the glass medium.

Table 2 - Comparative Example

Composition	Sample No. 2	P ₂ O ₅ -CaO based crystallized glass
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(% by weight)		
SiO ₂	53	34
MgO	7.5	5
CaO	39.5	45
P ₂ O ₅	—	16
Flexural strength (kg/cm ²)	1900	1800
Precipitated crystal (%)		
Apatite	—	35
Wollastonite	60	40
Diopside	40	25
Adherent strength to bone (kg)	8	8

In Table 2, the sample No. 2 in Table 1 was compared with the conventional P₂O₅-CaO based crystallized glass, and the flexural strength, types of the precipitated crystals and the adherent strength to bone were shown. The adherent strength was obtained by inserting a platy glass molded onto a size of 10 × 15 × 2 cm into a defective portion of a femur in a rabbit and removing and measuring the glass together with the bone after 10 days.

Comparing with the conventional P₂O₅-CaO based crystallized glass which precipitated apatite, it has been shown that the crystallized glass of No. 2 whose flexural strength is 100 kg/cm² higher is excellent in bioaffinity without adversely affecting surrounding tissues after 10 weeks, and firmly adheres to bone at the same level as the conventional ones.

As in the above, the crystallized glass of the present invention is excellent in mechanical strength and mechanical

workability as well as firmly adheres to bone, and in particular is useful as artificial bone materials with complicated shapes. The same effects can be anticipated when used as dental materials such as tooth roots and tooth crowns.

Furthermore, the crystallized glass of the present invention also has an excellent electric insulating property and dielectric property as industrial materials, and thus is useful for a field which requires such properties.